Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A cooling apparatus for fuel cell components comprising:

a base plate having a first end and a second end;

a first side plate coupled to said first end and a second side plate coupled to said second end;

a plurality of bottom ribs coupled to said base plate;

a plurality of upper ribs in physical contact with ~~coupled to~~ said bottom ribs; and

a top channel and a bottom channel formed between each of said plurality of upper ribs and each of said plurality of bottom ribs, respectively,

wherein said top channel and said bottom channel are disposed to allow an initial flow of a fluid therethrough in a top direction through said top channel and a bottom direction through said bottom channel, the top direction and the bottom direction comprising different directions, and disposed to allow a portion of said fluid to alternate between said top channel and said bottom channel at a flow redirection area so as to enhance the heat transfer rate between said fluid and said fuel cell components.

2. (Original) The cooling apparatus of claim 1, wherein said fuel cell components are selected from the group consisting of cathodes, anodes and electrolytes.
3. (Canceled)
4. (Previously presented) The cooling apparatus of claim 17, wherein said concavities are selected from the group consisting of depressions, indentations, dimples and pits.
5. (Original) The cooling apparatus of claim 1, wherein said fluid is selected from the group consisting of gaseous fuels and oxidants.
6. (Original) The cooling apparatus of claim 1, wherein said upper ribs are disposed at an angle in the range between about 30 degrees and about 120 degrees with respect to said bottom ribs.
7. (Currently amended) A fuel cell assembly comprising:

at least one fuel cell having at least two electrodes and an electrolyte disposed therebetween;

at least one cooling apparatus disposed over at least one of said electrodes, said cooling

apparatus comprising:

a base plate having a first end and a second end;

a first side plate coupled to said first end and a second side plate coupled to said second end;

a plurality of bottom ribs coupled to said base plate;

a plurality of upper ribs in physical contact with ~~coupled to~~ said bottom ribs; and

a top channel and a bottom channel formed between each of said plurality of upper ribs and each of said plurality of bottom ribs, respectively,

wherein said top channel and said bottom channel are disposed to allow an initial flow of a fluid therethrough in a top direction through said top channel and a bottom direction through said bottom channel, the top direction and the bottom direction comprising different directions, and disposed to allow a portion of said fluid to alternate between said top channel and said bottom channel at a flow redirection area so as to enhance the heat transfer rate between said fluid and said fuel.

8. (Original) The fuel cell assembly of claim 7, wherein said fuel cell is selected from the group consisting of solid oxide fuel cells, proton exchange membrane or solid polymer fuel cells, molten carbonate fuel cells, phosphoric acid fuel cells, alkaline fuel cells, direct methanol fuel cells, regenerative fuel cells, and protonic ceramic fuel cells.
9. (Original) The fuel cell assembly of claim 7, wherein said electrodes are selected from the group consisting of cathodes and anodes.
10. (Canceled)
11. (Previously presented) The fuel cell assembly of claim 18, wherein said concavities are selected from the group consisting of depressions, indentations, dimples and pits.
12. (Original) The fuel cell assembly of claim 7, wherein a plurality of concavities are disposed on a surface portion of said electrodes so as to cause hydrodynamic interactions and affect the heat transfer rate between said fluid and said fuel cell when said fluid is disposed over said concavities.
13. (Original) The fuel cell assembly of claim 7, wherein said fluid is selected from the group consisting of gaseous fuels and oxidants.
14. (Original) The fuel cell assembly of claim 7, wherein said upper ribs are disposed at an angle in the range between about 30 degrees and about 120 degrees with respect to said bottom ribs.
15. (Previously presented) The cooling apparatus of Claim 17, wherein the shape of said concavities is selected from the group consisting of hemispherical, inverted, truncated conical

and combinations thereof.

16. (Previously presented) The cooling apparatus of Claim 18, wherein the shape of said concavities is selected from the group consisting of hemispherical, inverted, truncated conical and combinations thereof.

17. (Previously presented) The cooling apparatus of claim 1, wherein a plurality of concavities are disposed on a surface portion of said top channel and disposed on a surface portion of said bottom channel so as to cause hydrodynamic interactions and affect the heat transfer rate between said fluid and said concavities when said fluid is disposed over said concavities.

18. (Previously presented) The cooling apparatus of claim 7, wherein a plurality of concavities are disposed on a surface portion of said top channel and disposed on a surface portion of said bottom channel so as to cause hydrodynamic interactions and affect the heat transfer rate between said fluid and said concavities when said fluid is disposed over said concavities.

19. (New) A cooling apparatus for fuel cell components comprising:

a base plate having a first end and a second end;

a first side plate coupled to said first end and a second side plate coupled to said second end;

a plurality of bottom ribs coupled to said base plate;

a plurality of upper ribs coupled to said bottom ribs; and

a top channel and a bottom channel formed between each of said plurality of upper ribs and each of said plurality of bottom ribs, respectively,

wherein said top channel and said bottom channel are disposed to allow an initial flow of a fluid therethrough in a top direction through said top channel and a bottom direction through said bottom channel, the top direction and the bottom direction comprising different directions at an angle in the range between about 30 degrees and about 120 degrees with respect to each other, and disposed to allow a portion of said fluid to alternate between said top channel and said bottom channel at a flow redirection area so as to enhance the heat transfer rate between said fluid and said fuel cell components.